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pulleys, in which the grooves are also wood, and wide, like those of figs. 7 and 8, and then pass upwards to pulleys mounted like *v*, fig. 7. The quantity or length of the fly-wheel's circumference which the bands engage is just double the length of the whole circumference of the mandril-pulley; and yet these small mandril-pulleys hold their bands so tight that they will slip round the fly-wheels, and not round the mandril-pulleys. This fact is in favour of the open or wide grooves, and against the V-shaped ones, and certainly in favour of using the whole circumference.

In fig. 7, the fly-wheel axis is shewn as running on a single friction-roller at each end, and is kept in place by passing between loosely-fitting upright pins or forks.

No. XI.

STAGE FOR A MICROSCOPE.

The SILVER ISIS MEDAL was presented to Mr. EDMUND TURRELL, 46, Clarendon Street, Somers Town, for his Improved Stage for a Microscope. The following communication has been received from Mr. TURRELL on the subject of his invention.

SIR, 46, Clarendon Street, Somers Town,
Feb. 14th, 1832.

THE great attention that has been lately bestowed upon the microscope, in order to bring it to the greatest degree of perfection, renders any apology from me unneces-

sary, in laying before the members of the Society of Arts what I conceive to be an improvement in the apparatus used for moving the parts forming the stage of a microscope.

The precision required in placing any minute object in the centre of the field of view in a microscope, gave rise to some very ingenious contrivances for moving the plate or stage upon which any object was placed for inspection. These being mostly capable of moving the object to be viewed in directions at right angles to each other, the plane in which they move being, for some purposes horizontal, and sometimes oblique, as circumstances may require, diagonal motion was, of course, produced by a compound of the two motions.

To effect these most necessary and desirable objects, two plates of metal are usually laid one above the other, each being capable of motion in the same or parallel planes, but at right angles to each other. The motion of one plate is produced by turning a milled head, attached to a pinion, which works in a rack fixed to the plate; a similar apparatus being combined to the other plate, or in some cases a screw is used to adjust one plate, while a rack and pinion is applied to effect the motion of the other; but whatever agents are used for the purpose, the milled heads are placed either on opposite sides of the stage, or else at right angles to each other. In either case, a person standing to examine an object in the microscope, and wishing to move a part out of the field, would be obliged to keep both hands employed upon the milled heads, to adjust and obtain his object, the body of the spectator being by these means rendered very unsteady; or, if sufficient steadiness is obtained under such circumstances, it will be at the

expense of considerable fatigue, frequently rendering microscopic investigation a painful rather than a pleasing pursuit.

It will be very clear that this difficulty may be greatly reduced, or entirely removed, provided all the milled heads used for producing the adjustments (whether for position in the field or the focus) could all be placed on one side of the instrument, and at so small a distance from each other, that the right hand only might pass from one to the other, without the necessity of removing the eye from the eye-piece of the microscope. In such case, if the right hand only be required to produce the various adjustments of the instrument, the left hand will be completely at liberty to form a third point of support for the body of the spectator, affording thereby considerable relief, and preventing the great fatigue that ensues from supporting the body in an inclined position, without any assistance from either of the hands.

In the instrument which I have now the honour of submitting to the notice of the Committee, all the milled heads, combined with the adjusting parts or agents, are placed on the right-hand side of the instrument, where for every purpose they may be used with the right hand only; but should a preference be given to use them with both hands (which in some cases may be found convenient), such a desire may be gratified, provision being made for that purpose.

I believe it is usual to procure certificates of approval from persons accustomed to use such articles as are submitted to the consideration of the Society of Arts; but when I reflected on the great number of gentlemen who are members, and who are in the daily practice of using the finest microscopes, I considered such a procedure would

be unnecessary, more especially as the object would be placed before those gentlemen whose practice in the use of the microscope renders them amply conversant with the subject, and therefore perfectly competent to form a correct judgment of its comparative merits.

I am, Sir, &c. &c.

A. AIKIN, Esq.

EDMUND TURRELL.

Secretary, &c. &c.

Description, with reference to the Engraving, Plate IV.

The particular convenience of this stage consists in the milled heads employed to produce motions at right angles to each other being both placed at one corner of the stage, so that only one hand is required to move them both; and, consequently, there is no necessity to remove the eye from the eye-piece, or to feel about to find the means to effect either motion that may be required. One of the agents employed to produce one of the motions (namely, a pinion) extends completely across the stage to the opposite near side, so that on particular occasions both hands may be used; viz. one for each motion, by which means any diagonal motion may be also produced at pleasure. The stage consists of three plates; the two upper ones sliding in cross dovetails, the bottom one may be attached to the microscope in any way that suits the convenience of the maker.

Fig. 1 shews the stage laid open, leaving only the bottom plate *a a*. Fig. 2 is the under side of the second or middle plate *b b*, with part of the third or upper plate *c c*, seen through it. In fig. 1 is shewn a double-threaded screw *d*, with a milled head; it is attached to the plate *a a* by the

straps or collars *e* and *f*: the axis of the screw *d* fits into a hollow conical collar near *e*, by which means all end-shake is prevented. There is nearly room enough for the upper half of the screw between the first and second plates *a b*, as shewn in the edge-view, fig. 3; but there still is a recess *g* made in the plate *b*, fig. 2, first to receive the half screw-hole *h*, and secondly to slide past the collar *e*, fig. 1. The half hole *h*, fig. 2, is formed at the end of a spring, so that it keeps in close contact with the screw *d*, fig. 1, and yet moves with freedom. Fig. 4: *i* is one of the dovetail slides removed from the plate *a a*, fig. 1; it fits against the two steady pins *j j*, and is retained there by three screws. Fig. 3: *i* shews an end view of it in its place; the opposite dovetail slide *k* does not require to be moved; the dotted lines seen in fig. 1 shew the inner parts when the plate *b* is laid on it. The screw *d* gives the right and left-hand motion; and, in order to produce the motion at right angles, the screw *d* is perforated to allow the long axis of the pinion *l* to pass through it, as shewn in the section fig. 5. This pinion is held in its place by two collars or straps *m* and *n*, fig. 1, and the leaves of the pinion are made so long as to extend the whole length between them; and the axis of the pinion, after passing through the screw *d*, is again supported by the elbow-piece *o*; and then the milled heads *p* and *q* are put on at each end. The head *q* is smaller than *d*, in order to allow the fingers to clear it when they are moving *d*. The pinion *l* moves a rack *r*, which is attached to the upper plate *c*, fig. 2, by two springs *s s*; they are screwed to the plate at *s s*, and are soldered to the rack only at its end *r*. Between them is a third spring *t*, which acts against the nearest end of the rack: thus every part of the rack is kept in pleasant contact with the pinion *l*. An opening is made in the middle

plate *b*, to allow the rack to pass through, and it is sufficiently long to allow of the longitudinal motion of the rack *r*. Fig. 5 : *c c* shews the dovetail sliding plate to which the rack *r* is attached, and which is therefore moved at right angles to the plate *b b*. The great length of the pinion *l*, fig. 1, between the collars *m* and *n*, is provided for the purpose of letting the rack slide along it when the plate *b b*, fig. 2, is moved either to the right or left by the screw *d*, fig. 1. By alternately using the milled heads *q* and *d* both motions are effected with one hand, or they may be given with both hands by using the heads *p* and *d*; in which case any diagonal direction may be given to the object placed on the stage to be viewed.

Fig. 6 is a top view of the stage put together; the dotted lines *v v*, on either side, shew the extent of the lateral motion; the milled heads *p* and *d* being placed far enough out to give the required range of motion towards either side. There is a dotted line *u u* at the near end of the upper plate *c*, to shew how much must be filed out to clear the stem of the microscope, if the stage was mounted close to it. In the middle of the plate *c* stands a neck, and on it slides the outer tube *w*, figs. 3 and 5: it carries the upper stage *x*. Fig. 7 is an under view of this upper stage; and fig. 8 a section of part of it, to shew the manner the spring-pins *y y* are racked, to allow of their being raised and lowered by the double pinion *z z*. These spring-pins fit into their sockets in the usual way, only the sockets have hollows filed in them to receive the pinions *z*, as shewn in fig. 8. *l l* are the pinion-bearings. In fig. 3 the milled head is removed from the end of the axis of the pinion, to shew one of the springs *2*, which are curved, but drawn flat by the screws *3 3*: these give an easy friction to the pinion. *4 4* are the

right and left milled heads, by which the springs *y* may be raised or lowered by either hand.

This rack-motion to the springs is a great addition to their use; for, when pressing the springs down by hand, the face was frequently obliged to be raised from the lens, and then they would sometimes crush a delicate object laid on glass under mica; but by this pinion they may be lowered most gently; and then, whilst viewing the object, it may be pressed the due degree, so as to flatten it or spread it out sufficiently to be viewed, and no more. They may also be raised enough to move the object, and then lowered again to hold it, without removing the eye from its view.

Fig. 9 is a light ball-and-socket holder for opaque objects. The wire 5 fits into the tweezer-joint; the ball has an elbow 6, into which fits a pin 7; upon this pin is mounted a short cylinder of ivory 8, having its top hollowed and blackened, the object being placed in the middle. A box, with a cork bottom, holds a number of these pins, with the objects ready mounted.

Fig. 10 shews, in section, a method of mounting transparent objects in ivory sliders, so as to be flush with their surface, by which the highest powers can reach them. Cylindrical holes are bored right through the ivory, leaving no seat; then, on the upper side is cemented a clear slip of talc, as long and wide as the ivory; the bottom is then turned up, and the objects being placed in, are followed by disks of talc and wire rings.